BETTER FRUIT

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This Edition Contains Instructive & Timely Articles on the Subjects of

Pruning & Spraying

BETTER FRUIT PUBLISHING COMPANY, PUBLISHERS, PORTLAND, OREGON

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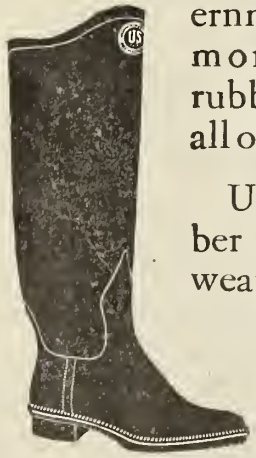

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Why Surrender to the Codling Moth?

By A. L. Melander, Entomologist, Washington State College, Pullman, Washington

UNDOUBTEDLY the codling moth has been increasing in destructiveness during the last few years. Even in the best regulated fruit districts the evidences of its work by harvest time are alarming. Well-intentioned growers thereupon make a firm determination to check the pest another year, and with a crop of wormy fruit well in mind harken to the plausible advice to emphasize late applications of spray. The destruction of fruit caused by late worms is a very noticeable and real thing; the few small apples lost early in the season can easily be disregarded, as so much needed thinning. It might be a pretty theory to speculate that extra attention in killing the early worms brings its reward in saving late fruit, but this is still generally regarded as theory, and farmers say that theories have little place for consideration when the fruit crop is at stake.

And so the man who advises repeated applications of strong arsenical spray in August and September is heard, and the orchardist, glad to postpone some of the drudgery of calyx spraying and forgetting his resolutions about theorizing, proceeds to experiment with late applications; and the codling moth has a splendid opportunity to increase its family at the expense of Mr. Fruitgrower. Fruit Inspector C. B. Woods of Yakima computes that the 1918 toll to the codling moth in his valley alone amounted to over $2,000,000, and this valley takes spraying probably as seriously as any district in the world. Something must be wrong. Is it the pump; is it the quality of the poison; is it that the dates for spraying are wrongly computed; is it that the solution is too weak; is it that the applications have averaged too few; or is it the labor problem?

A few years ago the horticultural press gave much attention to this important pest, and from the experiences, tests, studies, investigations and experiments then reported, a system of fighting the codling moth was evolved which has not been bettered to date. Briefly the steps involved and the reasons for each are the following:

1. THE CALYX SPRAYING IS BY FAR THE MOST IMPORTANT APPLICATION OF THE SEASON.

a. Most worms, both early and late, seek to enter the fruit through the calyx end and can be reached only by this spraying.

b. By checking the first brood it prevents the second and third broods from coming into existence and thus automatically reduced late infestation.

c. Paradoxical though it may seem, it is the best treatment to prevent side worms, stings and windfalls at harvest time, but should be followed up by thinning the fruit for worms during the time of the first brood.

d. It is the only application whose effects persists undiminished through the season.

e. Practically it destroys more worms than all other possible sprayings combined, and when properly given has often proved sufficient treatment for the season.

f. If poorly applied, later sprayings must be depended on and no amount of later spraying can make good the first neglect.

2. LATE SPRAYINGS ARE ALWAYS DISAPPOINTING.

a. They are hard to time correctly.

b. At best they reach only the relatively few worms that do not find the calyx end.

c. They never prevent all stings. Side worms are apt to reject their first nibblings of apple skin and thus unpoisoned enter fruit even heavily sprayed.

d. It is impossible to give a thorough coating of spray poison to the waxy apple skin; hence some side worminess always results.

e. Increasing the strength of the spray or the number of applications will not abolish stings and side worms.

3. THE CALYX SPRAYING MUST BE PROPERLY APPLIED.

a. The spray outfit must include high pressure (approximately 250 pounds is best), "tower" or elevated straddle, 8-foot rod, crook-joint and Clipper type of nozzle.

b. The spray-gun, disk nozzle, straight bordeaux nozzle or the dust spray will not answer. There is no better nozzle for calyx spraying than the large style Clipper with the angle joint. This nozzle should have a bore of one-tenth inch. The smaller hole of some Clipper nozzles will not assure sufficient penetration and is too wasteful of time.

c. Do not use so many nozzles that the pressure drops low. It is a penetration spray that is needed for calyx spraying. If your pump is too small do not grumble if your apples become wormy.

d. Except for trees just coming into bearing the spraying must be done from a tower or platform sufficiently high to enable the spray to be projected downward into the blossoms. For this purpose a saw-horse straddle fastened above the tank may prove sufficiently convenient.

Calyx spraying cannot be thoroughly done from the ground.

e. Every blossom must be squarely hit and soaked with spray into and even through the crown of stamens.

f. There is no spray better than arsenate of lead, one-half pound of powder or one pound of paste to about forty gallons.

g. Adding other materials, like lime-sulphur, boredaux, lime, soap or nicotine, may detract from the effectiveness of arsenate of lead, and is wasteful in that the calyx spray must be copiously applied.

h. Begin spraying when most of the petals have dropped; not before because then it is more difficult to fill the inner caylx and because of danger to bees.

i. The spraying must be finished before the calices close up.

j. A reapplication of this spraying after three or four days is highly advisable to catch blossoms not in best receptive condition before, and is worth more than any subsequent spraying that could be given.

4. COVER SPRAYINGS SHOULD BE CORRECTLY DATED.

a. To date the second spraying, immediately following the calyx applications fasten some mosquito netting like an inverted funnel around the trunk of a badly-infested tree, fitting the edges

Continued on page 33.

Ideal two-year-old peach tree ready for pruning.

Same tree after being pruned.

Pruning Peaches in the South

By J. A. Hughes, Horticulturist, American Refrigerator Transit, Missouri Pacific Railway

NO orchard operation so vitally controls the yield of peaches as does pruning. Where this is neglected, the amount of fruit produced decreases each year in quantity and quality until it becomes negligible.

The life of an unpruned orchard will rarely be over ten years, while a well-pruned orchard will produce twenty-five or more crops of fruit.

The trees should be headed very low, allowing from four to six leaders to develop. These should be cut back severely the second and third years. By doing this, a sturdy frame is secured which spreads out like a vase and affords a large surface upon which the smaller branches and fruit spurs may develop. The maximum amount of sunlight is admitted, which is so necessary for the production of highly-colored fruit.

The ideal peach trees are stocky with comparatively short and rigid leaders. These are secured only by heavy pruning during the first four years. Such trees are able to hold up heavy crops of fruit and maintain the greatest exposure to air and light.

Where heavy pruning is not done the leaders develop into long and slender whip-like branches, which when heavily loaded either break to pieces or bend down into a dense prostrate mass. The fruit borne on such trees for obvious reasons is poor in quality and always contains many culls.

A low-headed tree is easily pruned, thinned and sprayed, and the fruit can be picked without ladders, thus saving much time and avoiding bruised fruit. In Mr. Bert Johnson's four-thousand-acre peach orchard in South Arkansas there is not a ladder. He has never used one, and says they are not necessary if proper pruning is done.

Fruit buds of the peach are produced only on the new wood, i. e., the fruit buds for the 1919 crops were formed on the new growth during the summer of 1918. Each year a part of the old wood should be cut back to keep up the production of new and bearing wood on the main branches. If this is not done, the bearing surface will continue to be formed out on the ends of the limbs, further and further from the center of the tree. A good rule is to cut back from one-third to one-half of the past year's growth. Always leave the new shoots coming out near the base of the main leaders. If these are pruned back one-half, they will produce much fruit and at the same time shade the limbs from the sun, thus preventing sunscald, which does so much damage in Arkansas. In thinning out branches as would interfere with the circulation of air and light.

Ideal six-year-old peach tree, properly pruned. Note low heading and open vase center, giving maximum crops.

Cut back in February for production of new bearing wood. The light shaded portions show wood removed.

The same in September (after U. S. D. A.)

When the trees become branchy, i. e., the fruiting surface being produced far out on ends of long branches, the trees should be cut back. The accompanying illustrations show a tree cut back in February, and the same tree in September. The large amount of wood removed in cutting back (heading back) causes a vigorous growth of new and bearing wood on the main branches. This enhances the life of the tree and greatly increases the yield.

When an old tree becomes weakened by disease or is injured by the winter, its usefulness may be prolonged for several years by dehorning. This is the cutting off of the main leaders to stubs of about one foot in length. During the following summer a vigorous new growth will form, which will be set with a heavy crop of fruit buds.

In the South, peaches should be pruned during the dormancy season. In the case of orchards pruned regularly and where it is seldom necessary to remove large limbs, the pruning may be done at any time during the fall and winter months. Heavy pruning, however, should be done only in early spring after danger of the heavy winter freezes is past. Trees cut back (headed back) in the fall are often killed by severe winter weather. This was very noticeable in Arkansas and Missouri during the winter of 1918. Wherever the trees had been cut back or dehorned they were killed by the freezes of January. The writer recalls one orchard in which eighteen acres was headed back in December, the remaining twelve acres not being pruned until March. All of the eighteen acres were killed, while none of the trees pruned in March seemed hurt. This is the universal experience of many of the peach growers throughout the South. A good adage regarding pruning peach trees is, "Use the hand shears any time, but the saw only in early spring."

Some Interesting Phases of the Pruning Problem

By C. I. Lewis, Chief, Division of Horticulture, Oregon Agricultural College

THE whole pruning question seems to be enshrouded in a combination of trite, perhaps platitudinal, or to say the least, empirical statements; such, for example, as prune in winter for wood, prune in summer for fruit; or heavy winter pruning stimulates or encourages a greatly increased wood growth and many other statements far too numerous to mention. The trouble seems to be that we accept many statements like the above as fundamental truths or foundation principles upon which to base horticultural practices, rather than recognizing that on the one hand they are merely the application of soem fundamental truth to a purely local condition and problem, or on the other hand we have failed to recognize that these so-called truths are merely errors or at least misinterpretations of certain fundamental truths. Again, in reading the standard books on pruning, the more recent bulletins on the subject and the numerous articles written by orchardists from time to time, one seems at once to become lost in a maze of contradictions. No sooner is an opinion formulated than along comes another writer reciting his experiences, and lo and behold it is entirely different from our previous conclusions, and we begin to reorganize our conclusions. A more detailed and careful study, however, will reveal to us that, after all, these writers may all be right if we understand on the one hand their local conditions, or if on the other hand we could accept certain statements which we can prove really fundamental; in other words, formulate some pruning principles which we can apply under all conditions. In a recent bulletin of the Oregon Experiment Station, Bulletin No. 149, entitled "Vegetation and Reproduction with Special Reference to the Tomato," Kraus and Kraybill have formulated a statement which, I believe, we can accept as a code, so to speak, and to which we can reconcile all our experiences in pruning. This code is based upon the recognition of the fact that there are two classes of food which enter the plant, namely, the moisture and mineral food or soil nutrients, principally nitrates, on the one hand, and on the other the carbohydrates, the sugars and starches which are synthesized or manufactured in the leaves. The interrelation or correlation, or as we might say, the balance between these two factors will allow us to formulate certain fundamental statements relating to general orchard practices, and more especially at this time, pruning. There are four general conditions of the relation of nitrates, carbohydrates and moisture within the plant itself, and the responses apparently correlated therein. These are:

(1) "Though there be present an abundance of moisture and mineral nutrients, including nitrates, yet without an available carbohydrate supply vegetation is weakened and the plants are non-fruitful. If, for example, either because of lack of storage or photosynthetic activity, the carbohydrate supply were greatly reduced, even though there were an abundance of available moisture and nitrates, then blooming and fruit production are very greatly decreased, and vegetation is also restricted. The suppression of vegetation in itself is absolutely no reason why fruitfulness should follow."

(2) "An abundance of moisture and mineral nutrients, especially nitrates, coupled with an available carbohydrate supply makes for increased vegetation, barrenness, and sterility."

In this case moisture, nitrates and carbohydrates are all abundant. Such a combination encourages rapid vegetative growth with little tendency for the formation of reproductive parts. "This condition differs from the proceeding in the availability of the carbohydrates. If, then, a pruning of any type were given to trees or plants with meager carbohydrate reserves or means for their continued synthesis, even though the nitrogen and moisture conditions are unchanged, there would be a tendency for decreased vegetation and fruiting. That this is the actual situation is evidenced by the recorded results of many investigations, especially those dealing with young or so-called vigorously growing plants."

(3) "A relative decrease of nitrates in proportion to the carbohydrates makes for an accumulation of the latter; and also for fruitfulness, fertility, and lessened vegetation. In such cases growth is expressed both as vegetative extension and specialized reproductive parts, either as a sort of balance or as an expression in favor of the one type or the other. Compared with the preceding condition, actual vegetative extension is apparently less. It is this condition which is of greatest commercial interest to fruit growers. It is an ideal condition to have trees making some vegetation each year, thus increasing and maintaining bearing area coupled with abundant fruit production. This nicety of balance can be and is maintained through many orchard practices, especially such soil treatments as will regulate nitrogen and moisture conditions, and such top treatments as can be managed through pruning. Sometimes no cutting whatsoever may be needed, but generally some is required. The desired results of such cutting might be to suppress all growth in one portion, encourage growth in another, or to maintain a balance between purely vegetative parts and reproductively modified parts in still others. These conditions could be regulated by severe or light cutting, depending upon the relative abundance of the carbohydrates, nitrates and moisture, pruning furnishing the most ready practical means of regulating the form."

(4) "A further reduction of nitrates without inhibiting a possible increase of carbohydrates makes for a suppression both of vegetation and fruitfulness. This fourth condition is most frequently encountered in very old trees, in those which are growing in impoverished or dry soils, or in those which have sustained certain types of injury which virtually amount to a ringing or girdling. In these cases vegetative extension is notably depressed, the foliage small and generally light colored, and there is usually an increased tendency toward flowering, accompanied or not, as the case may be, with fruit development. In many instances there is actually a relative decrease in the production of flowers. If this condition is due to a relative lack of nitrates or moisture or both in proportion to the available carbohydrates, then it might be expected that if the former were increased there would be first a tendency toward increased vegetation and fruiting, but on increasing these amounts more and more, a response wholly vegetative would finally result. Such increase could be brought about either by some top pruning which directly removes stored carbohydrates, or by increasing the available nitrates and moisture by the application of nitrogenous fertilizers and cover crops with or without irrigation, as the case may be. Both these methods and their gross results are well known and established in practice. In general, it may be added that for most tree fruits, a combination of the two is most useful, since if the available nitrogen is very low, to secure results by pruning alone, the potential bearing area must be so greatly reduced that the trees are no longer commercially profitable. On the other hand, the application of fertilizers or cover crops only, without some pruning, may result in a loss of some of the most profitable bearing area by overcrowding or the development of fruit of a poor commercial grade."

Let us apply these four statements to some phases of the pruning question. We will first consider the relation of the amount of pruning to certain reactions which take place in the tree. We have formed too strongly an idea, that with our mature trees pruning will cause a growth of unfruitful wood, or at least will materially reduce the next crop. This conclusion cannot be accepted as a fundamental truth. Its acceptance, however, has led in many cases to little or no pruning at all for our older trees in many of our commercial valleys, whereas such trees really need much more pruning, soil stimulation, fertilization and irrigation; in fact anything which will increase relatively the nitrates and decrease relatively the proportion of carbohydrates. Many growers also believe that the number of buds, spurs, and even flowers are indicative of the coming crop and show the yielding powers of the trees. Such a conclusion has led and is continually leading to many disappointments. We also tend to con-

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The Crown Gall

By Walter G. Sackett, Colorado Experiment Station, Fort Collins, Colorado

In purchasing nursery stock, as well as in buying other commodities, the investor does well to go into the deal with his eyes open. From the standpoint of the horticulturist, there are always certain things to be desired in young trees, but equally important is it that the stock shall be in perfect health and entirely free from disease.

Crown gall, in any of its various forms, is the one disease to be feared most not only because of its disastrous nature but because it is the one which the unscrupulous nurseryman will attempt to pass off on the unsuspecting and inexperienced orchardist. In whatever form crown gall manifests itself, whether as hard gall, soft gall or hairy root, it has been shown to be caused by a germ that lives in the soil and which enters the plant through wounds induced by poor grafting, careless cultivation and by borers, nematodes, etc.

In its ordinary form, crown gall is characterized by the appearance of swellings or galls, small at first, usually just below the ground line (crown) at or near the junction of the stock and scion; these may also occur on the small secondary roots. They may be either soft or hard galls; the former are smooth, soft, spongy white or flesh-colored outgrowths which may reach a very appreciable size during one season and then be entirely decomposed and disappear by the following spring; the latter increase in size more slowly, persist year after year, harden and become rough and warty on the surface with age. Frequently the disease assumes a form known as "hairy root," characterized by the presence of bunches or tufts of closely-matted rootlets with marked enlargements at their bases.

As the galls increase in size, the function of the adjacent conducting tissue is interfered with, and the circulation is impaired, as is shown by the poor growth and dwarfed appearance of affected trees.

The removal of the galls, a practice often indulged in by dishonest nurserymen, results in no permanent benefit. The thorough inspection of nursery stock and care in the cultivation of the orchards not to wound the crowns are important factors in the control of the trouble. Plant only on uninfected land and avoid heeling in healthy stock where the disease is known to be present in the soil.

Crown gall is an infectious disease and can be communicated from tree to tree and from one plant family to another. A partial list of the plants upon which it occurs naturally or upon which it has been produced by laboratory inoculation includes the daisy, tomato, potato, carnation, peach, rose, cabbage, grape, hop, sugar-beet, turnip, red beet, carrot, radish, chrysanthemum, oleander, marigold, pyrethrum, almond, clover, white poplar, Persian walnut, gray poplar, cotton, alfalfa, raspberry, geranium, apple, willow, quince and tobacco.

Home Dry Curing of Hams Bacon and Shoulders

To each 100 pounds of meat use 8 pounds of salt, 3 pounds of warm syrup (any good syrup can be used, or home-made sugar syrup may be substituted), 2 ounces of saltpeter, 3 ounces of black pepper and 2 ounces of red pepper.

All the above ingredients should be thoroughly mixed together. It will first lump up and darken. When these lumps are rubbed out the ingredients are ready to rub in the meat and should make a coating over it. The syrup causes it to stick. The meat can be put into a barrel or box or piled on the table, which should be clean. There will be a drainage which is better taken care of in a barrel or tight box.

Leave the meat six weeks in the cure and the extra heavy pieces a week longer. If you wish to smoke it, take it right out of the pile and hang it in the smokehouse, without washing and smoke it until you get the required color. Be careful not to have your smokehouse too hot, not over 120 degrees.

The home curing of pork is an art which can be easily acquired. Farmers' Bulletin 913 gives information about the preparation of the farm-meat supply. Obtain it from the Agricultural Extension Service.

WILLIAM E. SCHNEIDER,
Swine Extension, University of Arizona and U. S. Department of Agriculture.

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Art of Top Working and Bridge Grafting Fruit Trees

By W. S. Brown, Oregon Agricultural College, Corvallis, Oregon

REASONS for top working: Fruit trees are top worked usually for one or more of the following reasons: To change from unsuitable to desirable varieties. To place weak-growing wood of certain varieties upon strong stock. To work over seedlings or varieties that are immune to certain diseases. To shape over an old tree top or to fill in after accident. To provide for cross-pollination in an orchard.

BUDDING AND GRAFTING

Small Trees: Frequently the fruit grower finds it desirable to change the variety while trees are still young. It may be that he has decided after two or three years' observation that another variety will do better for him under his conditions than the one originally planted. Or it may be that there was a shortage of the particular variety from the nurseryman in the year he planted and he was forced to plant another variety which would make good as a stock, though undesirable for a permanent tree. The writer knows of several incidents of this kind. One where Grimes Golden was grafted onto the Northern Spy to change the variety when the young trees were some two or three years of age. Another where Ben Davis was planted because of a Newtown shortage, and subsequently worked over to Newtowns. There are very few commercial orchards, too, where there are not here and there trees not true to name. It is highly desirable to work these over either by budding or grafting as soon as the lack of uniformity becomes apparent.

FIGURE 1.—Showing T cut, insertion of bud, manner of tying, and the cutting of buds from the bud stick.

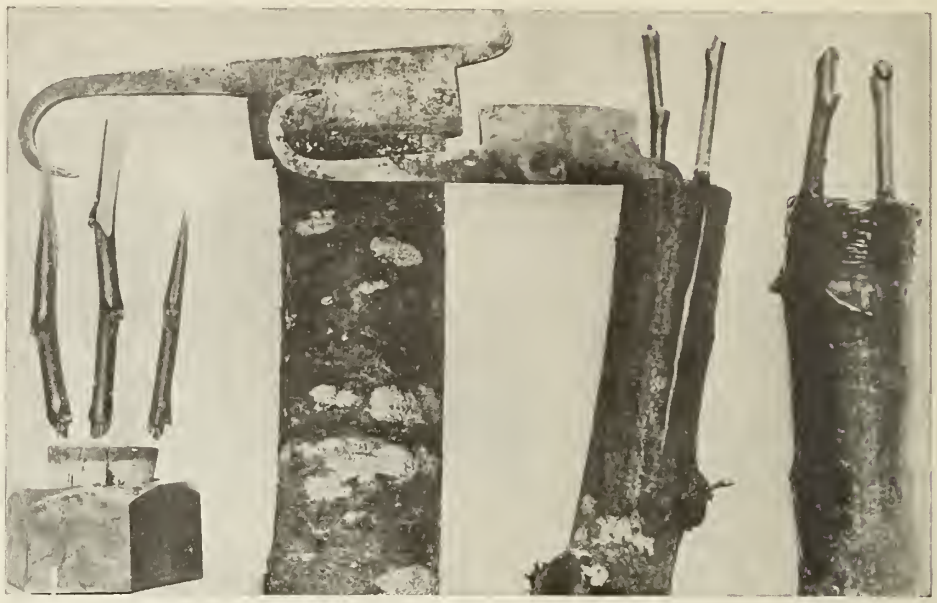

FIGURE 2.—Scions used in cleft grafting and way in which grafting is done.

Top working is being more and more applied to reduce the chances of destruction from diseases. As an example, we know the Bacterial Gummosis of the Cherry causes the loss of hundreds of young cherry trees each year. Many trees that are not absolutely dead might better be. It has been found that cherry seedlings of the Mazzard type are practically immune to the gummosis. Therefore, it is possible to grow the Mazzard stock for a couple of years, allowing the branches to be formed where it is desirable, and then to top work these branches to the varieties which are wanted for the orchard. In this way, the trunk and lower part of the principal branches are kept free from the infection. If a branch here and there is taken by the disease, it does not endanger the life of the whole tree. Similar work is being done with the pear. The Keiffer has been used as a stock for some time because of its relative immunity to blight, and the work of Professor Reimer of the Southern Oregon Experiment Station bids fair to develop for us several other pear stocks practically free from fire blight. By growing these stocks in our orchards we shall be able to protect the roots, trunks and lower portions of the principal branches from this dread disease.

Peaches that are getting too high in the air, if they have good strong branches, are often cut back severely and young branches are forced out as a consequence. If it is desirable to change the variety of these trees, the young branches can be budded to the variety desired. Prunes, also, can be budded on peach branches to good advantage. It should be remembered in this connection that the peach does not take kindly to grafting.

It may be said in general that budding does well with all the stone fruits and with the pear and apple, while the whip graft, which is sometimes used on young apples and pears, is not generally employed with the stone fruits.

Description of Top Working: Trees may be budded in the summer as soon as mature wood and good plump buds are available. The peach may be worked over in this way about midsummer, the cherry a little later, the apple and pear in the latter part of August or the first part of September. The equipment for budding consists of a knife with a sharp blade rounded at the point and sometimes fitted with a horn scalpel at the other end of the handle for lifting the lip of the cut, before the bud is inserted. Besides the knife, one needs strands of raffia cut in proper lengths for tying and thoroughly moistened. Limbs or "bud sticks" from trees of the variety desired are taken to the field in wet gunny sacks and kept thoroughly moistened. All bud sticks should have their leaves cut off, leaving the leaf stems in place.

The act of budding, when understood, is a simple one. It consists first in choosing a point on the branch where the new bud when set will have a good opportunity for growth and will grow in the right direction to shape the tree properly, etc. Then a T cut is made in this branch. The downward cut or stem of the T is made first. Then the transverse cut is made by holding the knife blade at a slight angle in order to lift the bark when this cut goes across the stem of the T. Next, if it is necessary, the bark is lifted somewhat to allow the bud to slip into place. The bud stick should then be taken and one of the buds removed carefully with a knife. This is done by starting the cut from one-third to a half inch above the bud and cutting carefully underneath the bud, including some of the wood, and coming out about one-half inch below the bud. With the stem as a handle, the bud can be taken and pushed gently down into the T cut

made on the branch. When the bud is solidly in place, the upper portion of the bud wood should be cut off transversely so that the wood will fit down tightly upon the stock. The stock is then wrapped carefully with raffia, beginning below the bud at the bottom of the T cut and working upward, taking care not to cover the bud itself, but wrapping securely about the top of the T. A good square knot, drawn tight, should be used. As soon as the bud has "stuck," which will usually be in about two weeks, the raffia should be cut in order that it may not girdle the branch and kill the bud.

Spring budding is often done soon after the sap has begun to flow by using buds from sticks cut and kept in a dormant condition until time of setting.

FIGURE 3.—A tree partly top-worked. Next year the job will be completed.

When it is desired to work over apple or pear wood two or three years of age, whip grafting is frequently used. Whip grafting is performed by making a smooth, straight diagonal cut across the branch to be grafted. Then a split of about an inch down through the center of the limb completes the cutting. The scion to be grafted upon this branch should be of last year's wood cut when the buds are entirely dormant and prepared for grafting by making a diagonal cut similar to the cut made on the stock. The stock and scion should be carefully fitted together, so that the cambium layers of the stock and scion may coincide at least upon one side. Unless the cambium layers touch at some point the graft will not be successful. Two or three buds are left upon the scion. Finally the scion is either waxed carefully or is wrapped with waxed muslin or waxed string. This grafting may be done in the early spring from a time shortly before the sap begins to flow until the buds have begun to open.

Large Trees: Often it becomes necessary to work over an old tree in order to change the variety or to fill in the top after some accident. A sleet or snow storm may take a valuable limb out of the top. Grafting is the only way by which this condition can be remedied.

On the large trees budding is very seldom used. Here and there on a one-year-old sucker or limb, budding may be used to try out a new variety or for purposes of cross-pollination.

Cleft and bark grafting are the methods used for top working pome and stone fruits. The cleft graft is more popular for the apple and pear, while the bark graft is used more frequently for the stone fruits, except peaches. The apple and pear lend themselves best to cleft grafting because the wood is so tough that it springs back upon the scion and holds it firmly in place. The cherry and prune are sometimes cleft grafted with fair success, but the wood is more easily split and does not hold the scion so well as does apple and pear wood. Consequently, the bark graft is more popular for the stone fruits. The bark graft is best for healing over large cuts on both stone and pome fruits.

Cleft Grafting: The equipment needed for cleft grafting consists of a fine-tooth hand saw, a grafting tool made of steel and equipped with a blade for making the split cut and a wedge for holding open this cut, a wooden mallet or a hammer, a small sack to hold the scions, and some grafting wax. If the weather is cold, the grafting wax should be in liquid form and must be kept hot in what is called a grafting pot. The essential features of these grafting pots are an alcohol lamp set in the bottom of a small bucket with holes made for draft and above a basin placed in the top of the pail to hold the melted grafting wax. Melted wax should be put on with a brush. In making the cleft graft, limbs of from one-half to two and one-half inches in diameter are chosen. These limbs are cut squarely across with a saw and the edges smoothed with a knife. The splitting tool is next brought into play and driven down into the center of the limb by blows from the mallet. A cut from an inch and a half to two inches long is made in this way. The splitting tool is then removed and the wedge of the tool is inserted near the center of the limb if it is a large one or at the side if it is small. The wedge is driven deep enough so that the scions may be placed at the edges of the cleft. Scions for grafting are chosen from the central portion of the one-year-old wood where the wood is mature and the buds are plump. Two or three buds are left on each scion. The scion is shaped by cutting a thin long wedge, starting on each side of the lowest bud, so that the buds will face outward when the scion

is set. The outside of the scion should be cut a little thicker than the inside, in order that the cambium layer of the scion may be held firmly against the cambium layer of the stock. When the scion is set it should be slanted slightly toward the outside in order that the cambium layer may cross. If the limb is an inch and a half or more in diameter, two scions are usually set. If it is smaller, one only can be set. As soon as the scions have been set and the wedge removed, the graft is waxed very thoroughly along the sides and over the top and the tips of the scion are also touched with wax to prevent evaporation.

Bark Grafting: In bark grafting the limb is cut at right angles with a saw as in cleft grafting. But, while in cleft grafting there are only two scions set, in bark grafting there may be several, usually about a couple of inches apart, around the edge of the cut. The scion for bark grafting is shaped by cutting a shoulder on both sides of the scion and leaving a thin wedge to be inserted between the bark and the wood of the stock. The bark of the stock is lifted slightly or is cut vertically at the points where the scions are to be placed. Then the scions are inserted. After all have been set they are waxed thoroughly and the tops of the scions are covered with wax. The scions are allowed to grow until they have covered, or nearly covered, the top of the wound and until they become rather crowded. Then they are gradually removed until two usually are left for permanent limbs.

At this point, it may be well to describe two of the most common grafting waxes used. The first one is for weather warm enough so that the wax can be properly molded in the fingers. The formula is as follows: Resin 4 pounds, beeswax 2 pounds, tallow 1 pound. Heat until thoroughly dissolved, but do not allow to boil; then allow the wax to cool in water till it can be pulled by the hand. It should be pulled until it is smooth and of a light color, much like taffy. This can then be laid away for future use. Grease the hands to prevent sticking. A grafting wax well adapted to cold weather is made as follows: Resin 4 pounds, beeswax 2 pounds, linseed oil 1 pint, and finely powdered charcoal ¼ pound. After the first three ingredients have dissolved pour in the charcoal and stir thoroughly. The charcoal has a tendency to keep the mixture from cracking. This wax should be kept warm in a grafting pot and applied with a brush.

Asphaltum (D or E grades) applied warm, with a brush, is a very good dressing also.

For whip grafts old muslin torn in half-inch strips and soaked in one of these grafting waxes when it is hot, or soft twine string soaked in wax are often used in place of the grafting wax.

BRIDGE GRAFTING

The purpose of this practice is to repair the trunks and limbs of trees when a large amount of bark has been removed in any way. Removal of the bark (a) allows heart rot to enter the tree and results in the decay of the limb or trunk, (b) cuts off the downward sap flow from the top to the roots, starving the roots and frequently causing the tree to bear too heavily.

Injuries of this sort may be placed in three groups: those caused by mechanical means, by diseases, and by climatic and soil conditions. The injuries of the first class include those made by cultivation tools, mice, rabbits, etc. Those of the second class are made up of such diseases as fire blight, cherry gummosis, apple-tree anthracnose, etc. The third class embraces such troubles as sunscald, sour sap, or winter injury.

Method of Grafting: This grafting is relatively simple, but requires great care. The scions in this case are usually cut when dormant, from the wood of last season's growth, and should be about the size of a lead pencil or a little larger. If dormant scions cannot be secured at time of grafting, fresh-cut twigs will answer if they are set immediately. The best time for setting is from the time when the sap is starting

FIGURE 1.—Illustrating how a tree badly girdled by winter injury was saved by bridge grafting.

well until comparatively late in the spring.

The dead bark is cut away from the wound or girdle on the trunk or branch and the green bark is evened up all around the edge of the wound. Cuts about an inch long are made up and down the bark from the edge of the wound, wherever the scion is to be inserted. Scions should not be placed closer than an inch and a half to two inches apart because there is danger of lifting up the bark between if they are set too close. The scion is sharpened at one end into a wedge similar to that used for cleft grafting and this wedge is inserted under the bark at the point where the vertical cut has been made. The distance needed for the bridge is then measured, leaving the scion long enough to bow out somewhat, and the other end of the scion is sharpened to a wedge in like manner and inserted. The grafts are then tied at the point of union with strong cotton twine or are tacked with fine brads. They are then waxed well with liquid grafting wax made according to the second formula given above. If twine is used it should be cut within two or three weeks. Later on in the season, when the tree trunk is entirely dry the bare wood under the scions should be painted with white lead and raw linseed oil, or with D or E grades of asphaltum. These preparations are much better than grafting wax, because grafting wax holds moisture underneath it and allows fungi to make growth there.

Many valuable trees have been saved to their owners in this very simple way. When a tree has been badly girdled it is well to follow the bridge grafting with a rather heavy pruning of the top.

Prevention of Injuries: It is well to bear in mind that much of this trouble can be prevented by a little care. When trees are young, they can be protected by wood veneer wrappers or wire protectors. Mice frequently do their girdling because grass, clover or alfalfa sod is allowed to grow about the trees, and they find this a hiding place during the winter. Again, after a heavy snow storm, mice may be prevented from working on the trees by packing the snow down around the trunk with the foot. Cultivation must be done as carefully as possible, and spraying must be thorough in order to control anthracnose. The only remedy for fire blight and cherry gummosis is to cut out the diseased portions as early in the season as possible and sterilize tools and cut surfaces.

Pruning

By Wm. H. Sawyer, Wapato, Washington

THE one thing, when we start to prune a tree of any sort, to get clearly in our mind is the object of pruning at all. Why do we prune? Some of the pruning we see done would seem to indicate that the pruner had an impression that the only object was to cut off part of the limbs, and which ones or when, or how, seemed to be a matter of no consequence. But that is a great mistake. I never allow a pruner upon my trees to cut off a single limb of any size unless he can give a definite reason for cutting that particular limb in preference to others near-by.

The things to be accomplished by pruning are definite and easily explained: The first object is to so shape the tree that it can develop and hold up a large or full crop of fruit, and the second object is to have the trees so shaped that the fruit produced will be of fine quality, and healthy and attractive in appearance. In the case of the Bartlett pear, which is the tree I have especially in mind at this time, to produce the first object, the limbs should be so distributed that the load will balance as nearly as possible over the center of gravity. Avoid hollow centers; but to secure our second object the whole tree must be kept so open by cutting away the shading limbs, that air and light can reach every piece of

fruit. Bear in mind that an attractive piece of fruit cannot be grown in the shade; air and light are absolutely essential. Bear also in mind that fruit buds and fruit spurs will not develop in the shade.

If the brush is well trimmed off the main limbs, they will soon be thickly covered with short fruit spurs, which will be bear great crops of fruit just where the tree has the greatest strength with which to support and develop it, and where it is most easily reached at harvest time, and where the storms and wind will harm it least.

Trees of the sort described can be secured in case of new orchards by planting one-year-old trees and cutting them off fifteen inches from the ground and at the end of the first year cutting out all but the five or six limbs that are the most evenly distributed about the tree and will give it the best spread; these limbs should all be cut back to from twelve to eighteen inches in length and cut to terminal buds that point out, excepting on the lee side of the tree, where they should be cut to terminal buds that point in, in order to brace the tree against the wind. Each following year these five or six main limbs should be cut back in very much the same way as the first year, and the brush kept well thinned out. By using this method of pruning a fine wide-spreading tree that will have strength to carry any kind of a load without breaking can be produced. In case of an orchard that has been badly pruned or not pruned at all, and the trees have grown way up into the air and are full of long slim limbs and thick brush, the trees can be brought into fine and nearly perfect shape by going at them without mercy and cutting limbs back to proper lengths, no matter if ten feet has to be cut off to do it, and cut the tops off enough to give the trees proper height, no matter how many feet have to come off to do that. Then thin the brush out, as I have described, and the trees can in a few years be brought into perfect shape.

In shortening any limb so much that it is necessary to cut into wood older than one year, I would, as far as possible, cut to a branch that can be made a terminal to the limb cut off, but if there is no branch near the point where the limb should be cut, cut the limb anyway where the proper length will be obtained. The only difference, when there is no branch to cut to, will be that a large additional number of new branches will be thrown out that will have to be cut off the following year.

Trees pruned as I have suggested will continue to grow thriftily for an indefinite length of time. I have orchards that in their twenty-fifth year made as much and as vigorous growth as they have ever made since they were planted, and they have always made the same vigorous growth and have produced very large crops of the finest quality of pears regularly for eighteen years. A paper entitled "Thinning Out versus Cutting Back" was read at the State Hortieultural Association meeting a couple of years ago. It seems to me that it would be just as pertinent to say "Horse versus Wagon," because one of the things, especially in case of Bartlett pears, is just as necessary as the other.

It will not strengthen the limbs to any great extent to thin out the brush and no great good will be accomplished by cutting the big limbs back properly if the tree is left so full of brush that no good fruit can be grown anywhere except upon the end of the branches or outside of the tree. To secure the best results the trees must be kept open and the limbs must be kept shortened back as I have described.

AN APPLE TREE

(By Edgar A. Guest.)

An apple tree beside the way,
Drinking the sunshine day by day,
According to the Master's plan
Had been a faithful friend to man.
It has been kind to all who came
Nor asked the traveler's race or name,
But with peasant boy or king
Had shared its blossoms in the spring,
And from the summer's dreary heat
To all had offered sweet retreat.

When autumn brought the harvest time,
Its branches all who wished might climb
And take from many a tender shoot
Its rosy-cheeked, delicious fruit.
Good men, by careless speech or deed,
Have caused a neighbor's heart to bleed,
Wrong has been done by high intent,
Hate has been born where love was meant,
Yet apple trees of field or farm
Have never done one mortal harm.

Then came the Germans into France
And found this apple tree by chance.
They shared its blossoms in the spring,
They heard the songs the thrushes sing.
They rested in the cooling shade
Its old and friendly branches made,
And in the fall its fruit they ate,
And then they turned on it in hate.
Like beasts, on blood and passion drunk,
They hewed great gashes in its trunk.

Beneath its roots, with hell's delight,
They placed destruction's dynamite
And blew to death with impish glee
A gentle, friendly apple tree.
Men may rebuild their homes in time,
Swiftly cathedral towers may climb
And hearts forget their weight of woe
As over them life's currents flow,
But this their lasting shame shall be:
They put to death an apple tree!

Orchard Irrigation

By R. L. Adams, University of California, Berkeley

WATER requirements of fruit crops are gauged by the variety of fruit, age of the trees, soil types, and climatic conditions. In general, or at least as near the one figure will express it, an equivalent of 30 to 36 acre inches of water (irrigation and rainfall) must be available for the use of a mature tree during its growing period. Fence irrigation practice is mostly confined to sections either having limited rainfall or else in danger of suffering from long periods of drouth. As practiced commercially, water for irrigation purposes is mostly derived from streams by some gravity system, or by pumping—communities often working together co-operatively to bring water from remote districts or in large volume for extensive tracts of land. Where an extensive system is desirable, the need is sooner or later met by community action, and the problem of the individual grower confines itself to a determination of whether or not he personally can afford to use water for his trees.

Will It Pay? It makes little difference whether a grower takes water from a public, a community controlled, or a private system, or puts in an independent pumping system of his own. In any case, the way of finding out whether or not it will pay is the same. To meet the various expenditures incident to the upkeep of a system, the returns from the crop, by improving quality or increasing quantity of the yield, or the enhancing of the value if a young orchard, must fully offset all items of operation, upkeep, depreciation and interest on the money. For instance, a plant just put in to supply enough water for a twenty-acre orchard has cost the owner $820. The various items to be covered by increased return are:

Interest on plant—6% on one-half cost	$25
Depreciation and renewal—10% on original cost	82
Repairs and maintenance—3% on original cost	25
Running irrigation furrows in orchard three times	45
Running expenses—fuel, oil, grease	67
Labor applying water and attending plant.	92
Cultivating furrows after irrigating	45
Cleaning ditches, annually	5
Giving a total of	$386

Since this orchard comprises twenty acres, each acre must produce enough more in intrinsic value of the orchard, or in cash return, to equal $19.30 per acre. And yet there is danger of being too conservative. In some of the citrus belts of the United States, the open soil types, the long periods of rainless weather, and large demands made upon the moisture by an evergreen tree have brought about some wonderful examples of irrigating systems, costing in some instance several hundred dollars for a share of water in a co-operative enterprise. Individual systems consisting of pumping plants and a distributing system comprised of numerous lines of concrete pipe run the cost up to as high as $60 per acre for the initial installation. Yet the value of the crop under proper methods of handling fully justifies the expense.

The cost of providing water must of necessity be computed independently for each case. The cost will depend upon the system to be used, the source of water, the amount required, when it is to be applied, and how large a head is needed. In considering the installation of irrigation, a form such as the following may be used to advantage:

Kind of fruit in orchard—Prunes.
Acreage—Ten acres.
Source of water—Wells.
Method of obtaining water—Private pumping plant.
Method conveyance to orchard—Concrete pipe.
Method of distribution—Six furrows between rows of trees.
Probable periods of applying—May, June, July.
Amount required each time—Six inches.
Time limit for each application—Eight days.
Flow required (including estimate of ditch loss)—120 gallons per minute.
Cost of pumping plant—$600.00.
Cost of conveyance system—$100.00.
Cost of distribution system—$.....

Such a variety of conditions are to be met that a little outline of this kind helps in crystallizing the problem and in pointing out the need of possessing a well-defined idea of what is really

Continued on page 20.

BETTER FRUIT

An Illustrated Magazine Devoted to the Interests of Modern Fruit Growing and Marketing.
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THE ORCHARDIST

The orchardist is a wise husbandman;
He cannot sow only and reap—
He must study and grow and broaden
While the "hay-seed" is asleep.

He must study the soil and the climate,
He must know the vales of the air,
He must know of the markets and drainage;—
He must answer his own day's prayer.

He must know of the trees and their growing,
Of sap and of bugs and of blight,
He must know where the water is flowing
At two a.m. in the night.

He must know of bugs and diseases,
He must know them, and know them aright;
He must fire the smudge when it freezes;
He must fight, he must fight, he must fight!

Economy in Raising Fruit. — The tractor is playing a very important role in the matter of economy with the fruit grower. During the past two years the question of labor has been a serious one. In many instances the fruit grower had one or two sons and were able to do the work without the aid of outside help. But conditions changed—he was not only dependent on outside labor, but often it was very incompetent. The fruit grower began to investigate labor-saving devices. Tractors have commanded greater attention than probably any other labor-saving device. With the tractor the work can be done much more quickly. In the spring the soil dries out very rapidly—cultivation must be done quickly in order to conserve the moisture, and this is particularly true in districts that have not an ample supply of irrigation water. The moisture condition is far more important in orcharding than in any other kind of farming, because with practically all other farm products they reach maturity early in the summer, before the moisture is completely exhausted, whereas apples continue to grow until autumn. A fruit grower cannot always divide his time systematically. Some seasons are much shorter than others. Perhaps during the middle of his cultivation it is necessary to apply a certain spray, and while he is spraying the soil continues to dry and much of the moisture is lost. Many tractors are being put on the market that are adaptable to orchard cultivation, and every fruit grower who is in position to purchase a tractor should investigate and find out the tractor best suited to his needs, making his purchase early so as to be prepared when the spring work commences. I know of one fruit grower who had three sons and when the call came each son enlisted. The father was very anxious to keep the orchard in the up-to-date condition in which the sons had kept it. He purchased a tractor and a few weeks ago advised me that when his two remaining sons returned they would be enthusiastic boosters for tractors; that he had been able, with the aid of the tractor and not very competent help, to keep ahead with his work.

Where the acreage is small the cost of a tractor would be more excessive, and it seems reasonable to suggest that a community plan in reference to tractors would be successful, but where the acreage will justify it, it is the writer's suggestion that the grower investigate some of the makes of small tractors that are being put on the market.

Standardization.—A meeting was recently held in Sacramento, of the County Horticultural Commissioners' Association at which the subject of "Standardization" was the principal subject for discussion. Chief Deputy George P. Weldon, head of the Standardization Division, led a very interesting discussion, and we give a list of some of the problems that were discussed:

1. The problem of preventing the shipment of green, immature fruit.
2. The problem of uniform grading.
3. The problem of determining the most satisfactory package for the packing of each fruit and the standardizing of same.
4. The problem of picking, handling, packing and transporting fruit with less bruising.
5. The problem of amending the standardization laws so that some of the present weaknesses may be overcome.

The fruit growers of California intend to standardize their grade, so that no fruit will be shipped that is not "truc to grade." The purpose of the standardization act of California is to promote and protect the apple industry. Large quantities of apples from Oregon and Washington are shipped to California each year, and, generally speaking, this fruit has commanded a high price, but some of it was very inferior. The apple-standardization act will stop this practice, for it will be possible for Calinia to condemn all shipments that are not up to the standard of the act. The fruit growers of the Northwest, in order to get the highest prices for their fruit, must standardize their grade and pack.

The Importance of Spraying.—A few of the fruit districts of the Northwest did not pay as much attention during 1918 to the subject of spraying as was necessary. The loss from codling moth last year was so extensive that it ought to be evident to fruit growers that thorough spraying and good materials from reliable manufacturers are absolutely necessary. With the splendid prices that apples have been bringing fruit growers will fully realize their loss. Even at the price of one dollar per box, if a grower suffers a loss of 3 per cent, which sounds very small on a crop of 300 boxes per acre, the loss will pay for the cost of extra spray material. The year 1918 was very favorable and growers suffered but little from fungus, but this does not mean they can afford to be careless this season or omit any sprays, and the grower who has the idea that he will save money by omitting one application may find he has learned a dear lesson.

The Price of Apples

Sir: Mr. Clynes stated in St. Andrew's Hall that he had been enabled to reduce the price of apples and other fruits. On the 24th September we were informed through the press that the price of apples would be sevenpence per pound for all kinds. They are still selling at anything up to half a crown.

A little enlightenment on this anomaly would be much appreciated.—*J. K. G. in Glasgow Citizen, October 5, 1918.*

A local fruiterer has some very nice looking Australian apples for sale but is asking the ridiculous price of thirty-five cents each for them, at which figure, he says, he realizes just a bare profit, states the *Straits Echo.* This is about a dollar a pound, and at this price apples must, in Penang, remain a forbidden fruit for most people. It would be interesting to know what price the Australian and Tasmanian orchardist gets for his apples on the spot where they are grown. It is probably in the neighborhood of a penny per pound, so that every pound of apples sold at a dollar in Penang represents a gross profit of 2,700 per cent. Who gets all this? asks the Penang paper.—*North China Daily News.*

Dynamite for Tree Planting

By R. O. Keller, Manager The Plymouth Tree Expert Co., Ohio

I want to describe a method we employed to plant a thousand plum and sweet cherry trees in the fall of 1915. The method was new in this section and probably will be new to a good many of your readers.

They were planted on the Honey Creek Poultry Farm in Huron County, Ohio. For forty years it had been run as a stock farm. Many of the fields had been used for grazing purposes and the sod was very heavy. It was not desired to disturb this sod unnecessarily, as the owner desired to use the fields as feeding grounds for his poultry.

The tramping of the larger animals for so many years had made the sod very tough and hard packed. At a depth of from ten to twenty-four inches, we discovered a hardpan or shale which was from six to ten inches thick. We found it necessary to use a sharp-pointed instrument to get through this. Underneath the shale was a heavy clay.

After drilling our bore holes to a depth of about thirty inches, we loaded them with half cartridge charges of a low dynamite, which was tamped in with wet sand. The results of these shots were beautiful tree holes.

To keep our trees straight, we used a yoke and two extra stakes. A lot of scrub trees and granite boulders which were in the fields were blasted out before the planting was commenced.

On account of the poor soil on the orchard site, we deemed it necessary to haul in some richer dirt to fill in around the roots of the trees.

After the blasting, the holes were dug out to locate the pot-holes which were filled with the subsoil loosened by the

blast. The richer dirt was used only for the filling in around the roots.

The sweet cherry is recognized as a very difficult tree to raise even under the best of conditions. This particular job was an especially severe test of the blasting method. We did not finish the planting until the first of December. The ground froze before the holes were all filled. Water settled in the holes and froze also. This was followed by a severe winter and they were subjected to a succession of freezings and thawings, heavy snows and other species of neglect. The trees were not even trimmed or straightened up; in fact, not a thing was done to them after they were planted.

In spite of all this, 85 per cent of them are living today and doing finely. It would be my opinion, based upon my experience as a nurseryman, that less than 50 per cent of these trees would have lived had they been planted in any other way than that which we adopted. As a result of this severe test and the success of the experiment, I am now a firm believer in the dynamite method of tree planting.

Marketing Advice

From the Department of Agriculture, Division of Horticulture, Olympia, Washington

Misbranding or Adulteration of Apples

Decision No. 5608 of the Federal Food and Drug Division reads, "Apples labeled 'Gano Extra' were held to be adulterated and misbranded because of decomposition and filth. The defendant was found guilty and fined $200."

Moral—Mark the boxes correctly. Do not mark the grade above the pack.

Federal Inspection Fees

The Federal Bureau of Markets has decided to charge a fee of $2.50 per car, $1.50 for less than one-half car for terminal inspection by their inspectors, the fee to be paid by the person requesting the inspection. Checks should be made payable to the Disbursing Clerk, U. S. Department of Agriculture, or to the inspector at the time the service is rendered.

Storage of Fruit Desirable

Fruit should be placed in storage as soon as possible after being picked. The extreme warm weather of the autumn months has had a tendency to hasten the ripening of apples, hence they should be placed in cold storage immediately. Storage capacity is limited throughout the country and arrangements for this service should be made at once. Storage is a "safety-first" measure against bad weather and congested shipping conditions.

Water-Core

An abnormal amount of "visible water-core" is in evidence this season in some sections. Professor O. M. Morris, professor of horticulture at the State College at Pullman, Washington, says: "All fruit that is showing any indication of this trouble should be gathered as soon as it is sufficiently mature. Water-core found in the fruit this year is common to all fruit-growing sections. It occurs with more or less frequency nearly every year, but is seldom of commercial importance. It is not caused by any fungus, but is a physiological development and does no damage to the trees or succeeding crops. Fruits that are little affected may be stored in common or cold storage and marketed later. Water-core fruit should not be shipped, and is unsatisfactory for canning or evaporating. The state grading law excludes all apples with visible water-core."

The crop estimate for October falls below former estimates because of the increased per cent of culls due to late codling-moth larvæ infestation. In some instances the eggs have been packed on the apples and hatched after packing. Some growers have used the arsenical spray as late as September 15th with good results. Cold storage will deter the hatching of these late-brooding eggs.

The pear crop was moved at very satisfactory prices.

Good apples are finding ready sales at remunerative figures.

Orchard Irrigation

Continued from page 17.

needed, both in the way of information and equipment.

If water is to be obtained from a community ditch, the determination of the expense offers no special difficulties, but if a private pumping plant is to be established, a careful determination of costs is needed in making up a preliminary estimate. Fluctuations in price of materials, especially high under present war influences, necessitates individual calculations. Some help to a determination of what is needed may be gathered from the following data compiled from reliable sources (largely from University of California Circular No. 117):

Items entering into the installation of a pumping plant are determined by the source of water supply. The simplest cases comprise the use of a suction pipe extending into a surface supply, as a river or lake. When underground water is the source, provision for one or more wells must be made. A plant under such conditions requires an engine, pump, suction pipe, check valve, hand pump for priming, outlet pipe, connections for engine to pumphouse, possibly an engine pit (if lift is more than twenty feet), well casing, and possibly sand point or gravel screen. Care in determining the best method of installation and the best equipment for the local conditions will always pay. To the cost of the various items must be added the expense of drilling wells, cost of installation, and providing for protection. An idea of the size of plant needed is gained by calculating the amount of water needed and the time limits available for applying it. For instance, if a certain orchard of twenty acres must have three irrigations of six inches each during the season, the water to be applied in ten days of ten hours, and estimating the six inches to be enough to include ditch leakage, a plant must be available having a sufficient head to deliver one acre foot every ten hours, or one and a quarter cubic feet per second when figured according to the following rules:

1 acre foot of water equals 43,560 cubic feet.
1 cubic foot of water equals 7½ gallons.
1 second foot of water equals a flow of one cubic foot per second (sometimes called one second foot).
1 cubic foot per second will cover two acres approximately one foot deep in 24 hours.
1 cubic foot per second is equivalent to a flow of 450 U. S. gallons per minute.
1 miner's inch equals 10 U. S. gallons per minute.

As a basis of figuring, if local rates are not available, the cost of drilling wells should not exceed about $1.25 per foot for the first fifty feet, $1.50 for the next fifty, and an increase from then on of 25 cents per foot for each additional twenty-five feet in depth. This for a 10 or 12-inch well.

The size of pump, measured in U. S. gallons per minute, needed to give a six-inch depth of water on selected acreages when operated for periods as given, is:

Time available for pump—	*Acreage to Be Covered* 5 Acres	10 Acres	40 Acres
5 days of 24 hours..	113	225	900
10 days of 24 hours..	56	113	450
20 days of 24 hours..	28	56	225

Note that 10 days of 12 hours each is equivalent to 5 days of 24 hours; 20 days of 12 hours each to 10 days of 24 hours, and so on.

Of the several kinds of pumps, the centrifugal is most extensively used, both horizontal and vertical types, and generally prove satisfactory for total lifts of not to exceed fifty to seventy-five feet, the lower lift being the limit for the smaller sizes. Plunger pumps are used when supply is near the surface of the ground and the lift to delivery is high—over seventy-five feet. Other types, as deep air and air lift pumps, are used under special conditions of high lift.

The size of a centrifugal pump is rated according to the diameter of the discharge in inches. Ratings vary somewhat in actual practice, but for general purposes will deliver about:

Number of Pump	*Capacity In U. S. Gallons*	*Capacity In Second Feet*
2	100	.22
2½	150	.33
3	225	.50
4	400	.66
5	700	.90
6	900	1.60

In the project given above, a six-inch pump would therefore be required. The size of engine needed to pull a given pump depends not only on the size of the pump and type of engine,

WHEN WRITING ADVERTISERS MENTION BETTER FRUIT

but depends as well upon the lift to be overcome. By multiplying the brake horsepower per foot of lift by the lift, from data given in the next table, an idea is obtained of the size of engine needed.

Number of Centrifugal Pump	*Brake H.P. per foot*	*Efficiency of Pump*
2	.08	30%
3	.14	40%
4	.22	45%
5	.34	50%
6	.46	50%

Hence, in the example given above, if the suction lift from the surface of the water, when down to pumping level, is eighteen feet and the rise from pump to discharge is ten feet, then the total lift is twenty-eight feet, requiring, for the six-inch pump, .46 h.p. for each foot, or an engine of 12 h.p. (11.28 to be exact). Some idea of costs in normal times is presented in the following table:

COST OF CENTRIFUGAL PUMP

No. 2	$ 40.00
No. 3	60.00
No. 4	75.00
No. 5	85.00
No. 6	115.00

COST OF ENGINES

Horsepower	*Electric Motor*	*Gasoline Engine*
5	$110.00	$375.00
10	200.00	550.00
20	320.00	850.00
40	450.00	1600.00

A comparison of fuel, based on per brake horsepower per hour, permits an inquiry into which is cheaper, low installation and high fuel cost, or the reverse:

If gasoline is.....	$0.06	$0.10	$0.20	$0.26
Other fuels are worth:				
Crude oil, per bbl..	.55	.93	1.85	2.42
Coal, per ton.....	2.00	3.33	6.66	8.66
Electric power, per k.w. hour	.111	.185	.370	.480
Cost per brake h.p. per hour	.100	.166	.333	.433

For a rough estimate to cover cost of valves, priming pumps, all fittings, and suction but not discharge pipe, add 10% of the cost of pump and gasoline engine, or 20% for an electric plant. Installation costs about 5% of the equipment cost. Protection, in the way of a house, costs somewhere in the neighborhood of $40 or $50 for an ordinary sized plant as usually constructed. On estimates of costs, freight and hauling must also be included. Fixed charges are usually figured thus:

	Gasoline Plant	*Electric Plant*
Depreciation and renewal....	8%	5%
Repairs and maintenance.....	3%	1%
Interest at annual rate of.....	6%	6%

Attendance amounts of about 5 cents per hour of actual running for an electric plant and 10 cents for gasoline plants.

Conveyance of Water. The most common method of conveyance is the open earth ditch. As water increases in value, the usual open ditches are subjected to concrete lining or else replaced with cement or wooden or steel pipes. Lewiston Basin, in Idaho, is supplied with water brought over rolling hills in redwood stave pipes; the lemon groves of Corona, California, obtain water through concrete lined canals; the water obtained by citrus growers from the Riverside Water Company is conveyed in cement and vitrified pipe, while the Gage Canal System, in Riverside County, California, is supplied through riveted steel pipe from six to ten inches in diameter. A ditch of twenty-four inches bottom width, six inches deep and sloping sides, with a fall of three inches to one hundred feet, will carry about one and one-half cubic feet per second.

Preparing for Irrigation. Careful determination of the direction and rate of slope previous to planting an orchard will help to determine the direction of the tree rows, but whether irrigation plans precede or follow planting, a survey is first necessary to determine the contour of the land prior to actually installing the system. In general, when

the land is practically level, the water is handled by flooding little basins or checks made by throwing up plow furrows to form ridges between the trees, plowing in both directions, so that each tree stands in a little square by itself. Occasionally, when a good head of water is available or percolation is slow, every other row is skipped, thus throwing four trees in a group. The ridges usually rise to a height of eight or nine inches above the general level of the land, being made high enough to confine whatever depth of water is desired. Water is supplied to each basin, either by supply ditches which tap each basin or by operating the basins in series, filling the highest one until it overflows into the next, and so on down the series. When the last one is full the irrigator repairs all breaks, beginning with the last of the series, and works back to the ditch, leaving each basin full of water.

Whenever possible, the furrow system of irrigation is more generally favored. The furrows vary in length, depth and distance apart, but in general consist of four, five or six or more furrows plowed out between the rows, into which water in small heads is turned and allowed to slowly pass down to the end of the furrow. Shallow furrows are usually spaced two and a half feet apart and eight-inch furrows three to four feet apart. A slope of two to twelve inches is necessary in each one hundred feet of furrow, with three to six inches a general average. Soils of slow absorption, as clays or loams, require the lesser rate of slope, while open soils, as gravels and sands, are satisfactorily served where the slopes are more abrupt. Where fields have a greater fall than fifty feet to the mile, or if the soil texture indicates a lesser slope as more desirable, furrows should run diagonally across the direction of greatest fall. The length of the furrows will range from 200 feet for the open, more porous soil types, to 600 feet in heavier soils. Furrows are easily and quickly made each time by using two or three ordinary double moldboard plows attached to a sulky frame, a 12-inch corn lister, or with furrowing shovels attached to a cultivator frame. For best results some cross furrowing from the outside furrows is necessary between trees to cover what would otherwise be dry areas. The supply ditches, since these are permanent, should be located by a surveyor. The rate of fall should be about two to four inches.

The method of distributing water from a supply ditch into the furrows deserves some consideration. If the ditch banks are firm and not liable to wash, open cuts in the banks will serve. These may be further protected by using a piece of sacking or canvas to break the eroding action of the water, or pieces of shingles. Some irrigators use stable manure to close the cut, removing it each time as needed. In porous or open soils, or if close attention to the distribution of the water is not always possible, short tubes or spouts of metal or wood should be arranged, with a cheap gate to shut off the water. These may be made of lath or of four pieces of ¾x3-inch battens, according to the amount of water received, with a gate of galvanized iron fastened over one end by means of a wire nail and leather washer. The method of raising the water to a height necessary to turn it into the furrows by means of wooden checks, dams of earth or canves, or metal tappoons, is just the same as in any irrigation scheme, requiring no special variations for orchard work.

Practice of Irrigation. The need for irrigation is best determined by a frequent examination of branches, foilage, fruits, roots and soil. The first need is the determination as to where the bulk of the feed roots are located. Ascertain the nature of the soil around them and make frequent examinations to note the condition of the moisture. Usually a test of the moisture content, made by weighing out a given sample, drying it, and calculating the original moisture content, is safest. Six per cent by weight of free water is deemed sufficient to keep trees in a vigorous condition. This study should be thorough and complete for a season or two, from the results of which a general irrigation policy can be worked out for the orchard under consideration.

While it is necessary to know the prevailing conditions surrounding a given orchard, some idea of general practices may be instructive. The apple districts of Washington irrigate about May 1st, followed by three or four applications at intervals of three to four weeks. In Colorado three to five irrigations are given during the season. Orchardists at Lewiston, Idaho, water three times, beginning June 15th. In California, citrus trees are irrigated six or seven times at regular intervals during the summer, while deciduous fruits receive two to four irrigations. Conscientious and thorough cultivation to follow as soon as the land can be properly worked is a necessary component of irrigation. If best results are to be obtained, releveling the land and regular cultivation must follow each application of water.

Thus far in this article no mention of drainage has been made. Rise of the water table through oversupply of irrigation water, or natural peculiarities of the soil structure, may necessitate provision for removing waste water. This is a subject to be considered in connection with the supplying of irrigation in lands having a high water table, underground seepage pockets, or extensive layers of hardpan or impervious clay. Clearing natural open channels, use of intercepting drains, and underground drainage offer, however, a means of relief if an outlet can be provided whenever a remedy is necessary.

Cranberry-Apple Jelly—Apple juice, 1 pint; cranberry juice, 1 pint; sugar, ¾ cup; sorghum or syrup, 1¾ cups. Prepare apple juice as for apple jelly. Add prepared cranberry juice and boil five minutes. Add sweetening; boil until it gives the jelly test. Turn into glasses. A larger proportion of cranberry may be used if desired.

Markets and Market Expansion

By A. H. Harris, Publisher of "Better Cooking," Portland, Oregon

TEMPERMENTALLY and by training and environment, the producer is not a salesman. The science of production is entirely different from the art of buying and selling. The producer needs information on soils, climate, cultural methods, and above all he must have industry and constructive thinking. The middleman needs information on transportation, crops, demands of trade, refrigeration, finance, and above all he must have "a nose" for the needs of people as consumers.

From time immemorial the seller, whether for the time being he be producer or middleman, has been handicapped by not knowing what his competitor was offering or intending to offer for sale. The seller has always been handicapped by not knowing of all the markets within reach on the one hand and all the supplies in his line on the other. The wise middleman is the fellow who spends more time studying markets and supplies than he spends in worrying about paying the producer for the commodities he has bought and perhaps sold.

The middleman is necessary in transactions involving the usual commercial practices, delays and risks. Under ideal conditions the producer and consumer might be brought together, but until human nature changes a good deal ideal conditions will not become common in this country. And until commercial practices are changed, radically, the middleman in one form or another will remain in the fruit selling game, whether we like it or not. In other words, some sort of a marketing system must be maintained, and it is best for the producer at least that the most efficient system of selling be maintained with senseless competition obviated as much as possible.

Production always takes place in the country (except in industrial lines), and marketing always takes place in the centers of population. For this reason it has been possible for marketing abuses to establish themselves and retain hold long after they have been discovered and exposed. Producers are busy with their productive efforts at home, and they have little time or inclination to try to fully understand problems centered hundreds or thousands of miles distant, and, perhaps,

problems which have more or less of technical training and experience involved in their intricacies.

A most encouraging development on marketing methods in the Northwest has been going on for two or three years, and apple producers this year find themselves with excellent quality and high prices, as well as strong demand, in their favor. Prune growers have profited, largely, by the war, and they, too, have been brought face to face with better marketing methods. The consignment plague has practically disappeared in the Northwest, and the Federal government has gone a long way toward abolishing the unbearable abuses which for a number of years made fruit growing unprofitable and in fact threatened the industry in the Northwest. Inspection, reports, publicity, each in its way, has had the effect of driving out of the marketing game crooks and shysters, and the growers have been given a more equitable division of the profits of their labors.

The Federal government seems to have well fixed plans which will be worked out during the next few years, and the markets of the country will be cleared of the unconscionable practices of the past. A long step has already been taken in the system of insepction and marketing information, which has been spreading over the country since the European war broke out. There is no reason why fruit, prunes, apples, pears, berries, should not be sold for cash and at fair prices, and the Federal Bureau of Markets is making an effort to see that such will soon be the case where it has not already been accepted as the best practice for all concerned.

While war-time conditions have brought about better times for the producer, the war abroad has broken down the marketing connections which had been established in England, France, Germany and other European countries, and the task of rebuilding a marketing system will be one of the first problems which will face the Northwest fruit grower with the coming of real peace. Not alone must markets be developed in Europe, but South America must be taken care of, and above all trade with the Orient must be established on a large scale. With the establishment of steamship lines to the Orient and the development of American trade in the Far East, the fruit growers of the Northwest should open an entirely new and expanding field for their products, and at prices which will pay a fair profit.

When the war began, England and Germany in particular were good buyers of Northwestern apples. During the season of 1914 England bought 1,096,054 boxes of apples, as against 1,788,236 barrels, in the United States and Canada. The Canadian shipments were small in the aggregate. Practically all the boxed apples were packed in Oregon, Washington and Idaho. With the coming of war this business was lost, as was the business with South America, it being impossible for exporters to get ships to carry the product to the waiting markets. Competition in the South American markets will be found in Australia and New Zealand, but the cropping season is different, and no seasonal competition will result even with heavy shipments of apples, prunes and other commodities to the Southern hemisphere.

The greatest field for market expansion, so far as Northwest fruit goes, lies in China. Japan, Siberia and the Philippines offer fertile territory, and practical marketing methods should be introduced in each country, but in China the field is so wide, the population so great, the use of high grade fruit so limited, that for a score of years development work would find virgin fields.

Concluded in next issue.

Increasing the Flow of a Well

By Wm. J. Gochenour, Virginia

IT occurred to me that a description of my method of well drilling and blasting to open up the water veins would be of interest to readers of a farm paper. Below I am giving a description of some work of this kind recently done for the Chapin Sacks Manufacturing Company of Woodstock, Virginia. They wanted a supply of about 300,000 gallons of water daily to be used in operating their modern creamery and ice plant. The wells were sunk through very hard limestone. There were eight feet of earth on top.

The first well was sunk to a depth of 240 feet and produced only 30,000 gallons of water in 24 hours. By observing the rock strata and finding them very tight and almost without crevices, we assumed that the water courses were almost shut off and we decided that shooting would be necessary to obtain satisfactory results.

The charge used was 325 pounds of 60 per cent straight nitroglycerine dynamite. The charges were packed tightly in four-inch metal tubes (ordinary rain pipe), each section ten feet long. The first tube rested on the bottom of the well, the others being placed one on top of the preceding one until the explosives extended up the bore hole to within sixty feet of the surface. In the top tube (the last one put down), we inserted a deep-well exploder. This, of course, was imbedded in one of the sticks of dynamite. Connecting wire long enough to reach to the top of the well was attached to this exploder and the connecting wire in turn attached to the leading wire, which at the proper time was attached to the poles of the blasting machine. Each of the tin tubes had a tight bottom soldered on it. A bail wire was run through two holes in the top of the tube and a hook attached to a three-eighths-inch rope was then hooked into the bail and used in lowering the tubes. The rope and tube were left attached to the last charge lowered (the one containing the exploder). The object of this was to enable us to pull this tube up to the surface again and examine it, if for any reason the charge failed to go off.

The very last operation in a job of this kind is attaching the ends of the leading wire to the posts of the blasting machine. This should never be done until every one about the place is at a safe distance and everything in readiness to fire.

The shot above described produced the desired increase in water in a test over a period of two days and one night continuous pumping; they were unable to exhaust the flow and the water in the well lowered only six feet, showing standing water to a depth of 180 feet. Forty thousands gallons of water per day were pumped. If there is no water in a well about to be shot, I would advise, after the dynamite charges have been placed in position and everything in readiness to fire, that several barrels of water be poured into the bore hole or, better still, that it be filled to the surface because water will keep the air from the explosives and serves as the best kind of tamping for well blasting.

The Height of Heroism

As we read the records of war heroes there is an ever-compounding difficulty in squaring our own aid in winning the war with the performances of the men at the front.

We are proud of our Liberty Loan, Thrift Stamp and Red Cross records, and yet when we read the citations for bravery, our actions become insignificant in comparison, although just as necessary.

Take the incident of Sergeant S. L. Nickerson, Corporal M. J. O'Connell and Private Thomas Ryan of the 101st Infantry—all deceased. It is recorded that near Epieds, France, on July 23, 1918, that these three volunteered to act as human decoys by crossing an open field to draw the fire of the enemy. Machine guns which could not be located were holding up the advance and there was strong probability that the entire company would be wiped out if the men charged in the open.

Nickerson, O'Connell and Ryan said good-bye to their pals, went over the top walking proudly erect at different places on the line and were promptly killed. The machine guns were "spotted," destroyed and the glorious American advance proceeded.

Think of those three boys when you decide the size of your next and last Liberty Loan subscription. If you do think of them the amount will be larger than you planned yesterday. It should be.

Some Phases of Pruning

Continued from page 8.

fuse the amount and length of new terminal growth with the total growth which the tree makes. It is easy at a glance to note the new terminal growth, but requires careful scientific measurements to determine the actual growth which a tree makes. I believe we would be safe in stating that the average pruner believes that heavy dormant pruning increases the vegetative growth of the tree, and that the trees should be pruned heavily to cause them to grow more vigorously; a careful analysis of recent investigations would show that such a statement would need very materially qualifying and that, to discuss it, we should have a knowledge of the age of the tree, its vigor, variety and the general factors surrounding the tree. For example, Alderman and Auchter in their work with young trees, have shown that the lightly pruned young trees are taller, broader and make a greater total growth than the heavily pruned trees. On the other hand, in working with older trees which had entered a decline and were in abnormal condition, they concluded that pruning greatly stimulated, generally benefited and made the trees more productive. In this case, heavy pruning causing both more vegetative growth and the bearing of greater crops. Many of our older apple trees in the Pacific Northwest would respond in the same way. Bedford and Pickering in their work with twelve-year-old trees found that the heavily pruned trees were 16 per cent lighter than moderately pruned trees, while those unpruned were 20 per cent heavier than the moderately pruned trees. Gardner found young trees unpruned increase in size as rapidly, if not a little more rapidly, than trees winter pruned only, or both winter and summer pruned, that pruning caused more a change in direction of growth or determined the type of growth, but that the amount of growth was determined more by what the tree had done the previous year. We have in our experimental plots young trees which have not been pruned since they were two years old. These are fully as large as the pruned trees and have borne more fruit. They may not, however, be in as good form, so to speak, and have as desirable a framework for future crops. The system of pruning adopted by Mr. Sawyer of Toppenish, Washington, in his pear orchard is of great interest. Mr. Sawyer has one of the largest pear orchards in the Yakima Valley. Ii ts located in an irrigated section and he has had his orchard in alfalfa for many years. He prunes very heavily and as a result he gets a good growth; has little or no propping to do and gets a very heavy yield. His practices might be considered unorthodox, yet his results speak for themselves. All these cases cited are illustrations of our proneness to accept some local experience as something fundamental rather than merely an application of general principles.

Let us now consider the relation of place, of cutting and the kind of prun-

ing to certain tree development. The reaction and change which comes to a tree from pruning is found in close proximity to the wound. For example, you have often seen large pear trees dehorned; cutting off four or five of the main branches to mere stubs, perhaps leaving one or two branches as they were. The cutting off of large branches causes them to immediately throw out vigorous sappy growths which we might term suckers or watersprouts. It will be many years before such growths are fruitful because we have cut off all of the carbohydrates or starches out of such branches, material which we need in making our trees fruitful, and have substituted a wood which is excessively rich in the soil nutrients. But, on the other hand, if we will examine the two or three branches which are unpruned we will generally find that they did about as usual, bearing some fruit and making a small amount of growth. The pruning did not affect them, but reached only the branches which were heavily pruned. It has been shown in experiments at the Oregon Experiment Station that with pear trees, for example, bearing great masses or dense clusters or spurs, that such spurs can be greatly revitalized by thinning out a portion of them. This will revitalize the remaining spurs and furnish new wood for future spurs. If this is not done the spurs become weaker and weaker. To reach these spurs and stimulate them very much, prune in the clusters themselves and not in some other portion of the tree. By such pruning we change the proportion of nitrates and carbohydrates and bring about a condition which means fruitfulness. The questions of revitalizing and stimulating fruit spurs needs a closer study on the part of our growers.

In pruning our bearing fruit trees, the bud and the fruit spurs are two parts which we should give special study. Some investigations that we have made at this Experiment Station would indicate that the percentage of spurs that bloom from year to year decreases as such spurs get older, and that the percentage of spurs which bears fruit decreases at an even faster rate as they get older. In other words, some spurs may have the vitality to produce a bloom but have not reserve energy enough to set or, after setting, to mature a fruit. Our investigations have shown that the amount of growth that a spur makes for a given season has a close relation to its bearing the following season. There is also a correlation between bearing and length and diameter of spur. Branches that have a large diameter have stronger spurs and bear more fruit. From these results it would seem that the spur to a large extent acts as a barometer, and that a study of their vitality and the nature of the wood on which they are borne will determine to a certain degree what pruning should be given such trees. One should attempt to develop a fair amount of new wood annually in order to provide for the necessary increase of new buds and spurs essential to the best tree development and should constantly keep in mind the revitalizing of some of the older spurs on the trees.

We get a fine example in the Italian prune in the value of distributing the pruning of the trees. There are three kinds of wood on the average prune tree. First, the upright strong branching or staghorn wood, so to speak. This wood has a mighty bright future. Second, there is the wood which grows out horizontally. This wood has had a wonderful past, a fair present, but an

unpromising future; and third, the drooping wood; all it has is a past. In other words, the staghorn wood is beginning to bear, and in the near future will not only produce the most of the prunes on the tree, but also the largest ones. The horizontal wood, while still producing lots of prunes, is setting less and less blossoms and is tending to produce small fruit. The drooping wood may bloom, but it is generally too weak to produce fruit, or if it does produce, the fruit will be found to be of inferior quality. The problem of the prune, then, is to keep plenty of staghorn wood coming into the tree, removing the drooping wood. Many of our old prune trees should sacrifice one-fourth to one-half of their wood. Such a removal would immediately revitalize the remaining spurs and buds left on the trees; more fruit, larger sizes and new, vigorous wood is the result. Much of this drooping wood can be most cheaply and easily removed by putting on an old pair of gloves and simply breaking it out. Where a good vigorous sprout appears on the prune tree, remove some of the older wood next to it and give the sprout a chance to develop. Badly devitalized trees can be dehorned and new sprouts developed into fruitful tops in four years, but this should not be done unless necessary, as a vigorous thinning out will often revitalize many trees without the loss of the crop for three or four years.

Magness of the Oregon Station, in his Bud Study, has shown that each branch to a large extent is independent of other branches on the tree and must be pruned as an individual branch, so to speak.

We will now consider a few of the questions dealing with the season of pruning. At this time many growers would like to know how early they can start pruning. Owing to shortage of labor this is an economic question. Under normal conditions, there is no reason why pruning should not begin in late fall and extend on through the winter until early spring. One should avoid ever pruning frozen wood and should prune the older trees first. Any cuts exposed to abnormally low temperatures sometimes causes injury which leads to a sort of die back or killing of some of the tissues. This occurred in a few orchards in 1908, but would not commonly occur in an average winter. Many growers have been following too religiously the statement that winter pruning produces wood growth and summer pruning produces fruit. To a certain extent the results obtained from pruning in summer have not been materially different from

those obtained in pruning in winter. Pruning has been done in all seasons in varied amounts and of various kinds with equally varying results. Perhaps the tree is in a different condition at the time of summer pruning than it is during its dormant period. By summer the rush of sap, rich in moisture and mineral food, is largely ceasing for the year and we are not only removing wood, but also leaves which are the manufacturing or synthesizing agent in the plant. It is very popular to believe that the reduction in vegetative growth means an increase in fruitfulness. The removal of a certain amount of wood of the tree during the summer pruning will force the tree from a vegetative growth to a productive growth. Unfortunately a decrease in vegetative growth often means an actual decrease in fruitfulness. I noticed a Rome Beauty orchard this summer that had been very severely summer pruned. The trees presented a very grotesque appearance owing to the fact that the foliage on the Rome Beauty is often very sparse and the short, stubby growths and lack of foliage and the unusual exposure of the fruit, gave the trees an appearance far from natural. It will be safe to predict that this orchard will not bear much for a number of years. The grower has removed so many of the leaves and so much of his stored food that is necessary for fruit formation that he has not only lost the stored food but has removed the means of getting new fruit in the near future. Such a summer pruning is simply devitalizing, dwarfing and injurious to the trees. Mr. Magness of the Oregon Station has shown the important role which leaves play in some extensive defoliating experiments which he carried on. His conclusions are worth repeating at this time.

"1. Fruit-bud initiation will not take place, and fruit buds will not form in most varieties in the absence of a fair amount of leaf area in the tree.

"2. Leaf area in one part of the tree will usually not supply food material to the buds in another part to the extent necessary to cause them to become fruit buds. Defoliating one-half of a tree has little influence upon the undefoliated portion, but that part which is defoliated functions as it would if all the leaves had been removed from the whole tree.

"3. Food material stored in the tree through the dormant season is apparently stored largely in the tissue adjacent to the leaves in which it was manufactured. This is shown by the fact that the defoliated portion of a tree does not develop as strongly and well during the spring following the treatment, as does the undefoliated portion.

"4. Removing the same number of leaves, without any pruning, has practically the same effect upon the fruit-bud formation for the immediate year following that a summer pruning, removing leaves from the same position would have.

"5. Buds on one-year wood, in areas from which the leaves have been removed, are slower in starting out into

growth, and make a weaker growth the following spring than do other buds on the same shoots not defoliated. This is more noticeable in some varieties than in others.

"6. One shoot seems to be very largely independent of other shoots about it so far as fruit-bud formation is concerned. It is apparently largely dependent upon its own leaves for nourishment.

"7. Removing leaves from individual spurs tends to prevent the formation of fruit buds upon those spurs, although it does not entirely check the development of flower parts.

"8. On those spurs which form fruit buds, notwithstanding defoliation, the blossoms are, on the average, considerably later in opening in the spring.

"9. Axillary buds of the Wagener seem to be almost entirely dependent upon the immediate subtending leaf for the carbohydrate supply with which they are nourished. Removing the subtending leaf entirely prevents fruit-bud formation. Buds so treated either remained entirely dormant during the following growing season or pushed out into very weak growth. Very few of them showed a development approaching normal.

"10. Microscopic examination of buds, both defoliated and undefoliated, taken at intervals during the summer, show little influence of the defoliation so far as development is concerned. No buds were studied that were taken later than Setpember 12.

"11. There is a very decided decrease in the number of calcium oxalate crystals deposited in the tissues of defoliated as compared to undefoliated buds. This may be indicative of a small supply of soluble carbohydrates and general slow metabolism in the bud tissue.

"12. Injury to the bark on the trunk of the tree very greatly stimulated fruit-bud formation. This injury brings about very different conditions of nutrition in the tree from those produced by defoliation, for by preventing the normal flow of elaborated foods to the roots, the supply in the top of the tree is greatly increased by the injury of the bark."

The results obtained by various investigators will in some respects seem to be perhaps contradictory. However, before coming to such a conclusion one should study the amount of pruning which was done at the time at which it was done. Alderman and Auchter, working in West Virginia, came to the general conclusion that summer pruning checked the tree growth and greatly decreased its fruit production; that on some trees five and six years of age, summer pruning decreased both their vigor and fruitfulness. Other investigators have had similar experiences; however, we find our experiments in the Oregon Experiment Station have produced somewhat different results. We have been able to gain a year in building the framework of the young trees; have also been able to bring fruit spurs on certain portions of the tree earlier with certain trees and have been able to keep them in a

better bearing condition with summer pruning, but our pruning is very different from that, as we removed relatively small amounts of wood. The pruning was generally done in June and consisted of pruning back the terminals. In such prunnig we did not remove large quantities of stored food, whereas most people experimenting with summer pruning have removed large amounts of both foliage and wood, which always seems to have a tendency to decrease fruitfulness and vegetative growth. With Jonathans and Wageners and varieties which form fruit buds on one-year-old wood, the value of light summer pruning versus winter pruning can be easily illustrated. If we cut back in winter the one-year-old wood severely, we are removing a large portion of the crop. Such trees can often be allowed to go unpruned for a year or two at a time, but when pruning is done, a lighter heading back in early June will still have a large portion of the crop and give desirable framework for future crops. Summer pruning can also be of value in thinning trees which are excessively dense. This must be done carefully, however, so that one does not remove too much wood containing stored food which will form buds and spurs, in order to allow a certain amount of light to enter the tree. The loss of stored food may not compensate for the increased amount of light.

Le us see in what way we can apply these general principles of pruning. With our young trees from three to five years of age, the great value of pruning seems to be largely to determine the type of growth and its general direction. As the tree enters the transition period from five to ten years of age, we should allow it to accumulate the carbohydrates and discourage an excessive amount of growth rich in nitrates. We do this by not stimulating the trees through tillage and similar practices and by avoiding removing large amounts of wood rich in carbohydrates. As our trees become mature and begin to bear heavy crops, we have a condition such as is shown in the third statement as quoted from Kraus and Kraybill. Everything goes nicely for awhile, but gradually as the trees get older the proportion of the carbohydrates in relation to the nitrate begins to increase and the nitrates begin to decrease. The trees cease to make vegetative growth. After a while the foliage gets yellow and thin. There is still an abundance of spurs, buds and flowers, but an unsatisfactory amount of fruit, and very soon we have the conditions which is stated in No. 4 by Krause and Kraybill. These trees will have to have more pruning and a different soil treatment if they are to be made productive.

In conclusion I would urge modera-

tion in the pruning of bearing trees, avoid excessive heading back or excessive thinning, but practice more the moderate heading and moderate thinning. Excessive pruning of any kind leads to unstability and generally an unsatisfactory relation between the nitrates and carbohydrates. Moderate pruning practiced regularly for our bearing trees should be a good rule. We should also attempt to distribute this pruning quite generally throughout the tree. If the trees are allowed to go untouched, they will soon reach a condition of equilibrium, but it is a condition of equilibrium which means little vegetative growth and little fruit production, and affects our pocket-book, so that it soon reaches likewise an equilibrium, but one that is always below cost of production.

Planting Trees Over Hardpan

By Otho Strayer, Alabama

Six years ago F. S. Vaughn, of Axis, Mobile County, Alabama, set out two hundred Satsuma orange trees. The top soil of the orhard site was about six to eight inches in depth; then followed a very hard clay, and below that a softer and more plastic clay. It was a cut-over timber tract and along one side of it, paralleling a railroad, was a strip that had been originally an old log road. The ground along this strip was packed extremely hard.

Mr. Vaughn was doubtful of the success of an orchard planted in such soil, but having heard that dynamite used to loosen the soil would give the trees a better change for life, he decided to try it. When I saw him a few weeks ago he was very much pleased with the experiment. He told me that when the trees were three years old they were the finest trees in Mobile County for their age. They were larger than any other trees in the vicinity and presented a better appearance in every way. In fact, he said that they were as large as the average five-year-old trees in adjoining orchards. They were six years old when I saw them and then compared in size with other trees two years older.

In the fall of 1916 Mr. Vaughn set out his pecan grove by the same method. He used one-third of a cartridge of 40% dynamite in each hold, and in all set out three hundred trees.

He expects this experiment to be even more successful than his former one, because owing to the long taproot of the pecan tree it is desirable to have a deeper and better broken up bed upon which to set it than is necessary for the Satsuma orange.

No-Man's Land Soon to Grow Crops

The French government has already made arrangements for bringing back into cultivation the desolated and war-torn areas from which the enemy has been driven. The dense population of France makes prompt agricultural restoration necessary to relieve the food situation. Preference will be given to farmers who originally lived in the invaded regions.

Why Surrender to Codling Moth?

Continued from page 5.

tightly against the ground, so that when the moths emerge from their winter cocoons underground at the base of the tree they become trapped. Spray two weeks after the moths begin to emerge.

For a given locality this date is almost fixed by calendar. Year after year at Yakima it has come in the first week in June, irrespective of the earliness or the lateness of the season. It is the date for the calyx spraying that shifts. Apples may blossom two weeks to six weeks before the worms appear.

b. Do not depend on dates obtained from moths emerging from bands, loose bark, packing boxes or sheds, or from breeding cages kept in unnatural conditions.

c. To date the third spraying, keep some trees banded with strips of burlap tied around the trunks. Watch for worms two to three weeks after the second spraying and date the third application twenty-five days after the first worms are caught. At Yakima this spraying will be given about July 20.

d. The number of worms trapped by the bands gives an indication of the effectiveness of the spraying for the first brood and of the need for later sprayings. Thinning wormy fruit during the time of the first brood is of great value in checking the pest and also helps in deciding whether late sprayings are necessary. When the first brood is annihilated late spraying is a needless expense.

e. The fourth spraying should follow four weeks after the third, and, if necessary, the fifth four weeks later.

f. If these applications have been carefully given, no good can come from additional sprayings. It should be remembered that cover sprayings can never be depended on to give 100 per cent returns. At best they are an expensive supplement to the calyx spraying.

5. COVER SPRAYINGS SHOULD BE QUICK ACTING.

a. Use arsenate of lead, one to two pounds of paste, or half as much powder, to about forty gallons. Increasing the strength of the spray over this amount will not save more fruit.

b. Where there is no danger of scorching use arsenite of zinc or arsenate of calcium for late sprayings of badly-infested orchards. These arsenicals act more quickly than arsenate of lead and hence tend to minimize stings.

c. Spray from the ground, best using the spraying-gun with power pump, and do not overdo the application. There is no need of having the trees drip poison onto an alfalfa cover crop to endanger bees and stock.

If you lost your fruit crop to the worms: (1) Don't blame it onto too

few applications, for the calyx spraying will alone save more fruit than a half dozen careless applications. (2) Don't blame the quality of the poison. Federal and state insecticide laws are too strict for any manufacturer to risk selling low-grade arsenicals. (3) Don't say your spray was too weak, for the weakest spray here recommended (which is probably less than you used) is twice as strong as is necessary to kill the codling worm. (4) Don't complain that you were given wrong spraying dates. Missing the exact date by a week will not lose more than a small fraction of your crop.

If your fruit crop was wormy own up. You didn't have a tower, or a penetrative angled nozzle, or a high capacity and pressure pump, and you didn't see to it that every blossom was squarely soaked at calyx-spraying time. You risked your crop with the hired man, or you took a chance in experimenting with some new nozzle or some new scheme for spraying. The test for a thorough calyx application, aside from a relatively clean crop, is the absolute elimination of calyx worminess. Not a reduction of calyx worminess down to 5 per cent, but no fruit at all wormy at the calyx. With a proper equipment and a little care this condition can be attained by any orchardist.

It seems strange that, with a practical method of control so completely understood, fruit growers should be willing to gamble their prospective crop to avoid a little of the drudgery of the calyx spraying. That the blossom end of apples cannot anywhere near all be filled from the ground has been demonstrated time and again. And yet, knowing this, fruit men persist in neglecting the "tower." The fruit inspection service of Yakima County stated that last year in this district less than a dozen pumps were equipped with towers. Two million dollars is a pretty price to pay for such neglect. It is not so much that we need government and experiment station entomolgists to discover more facts about the codling moth as it is to put into practice what we already know.

Syrup from Apple Culls

For those who have a great many second-grade apples and culls on hand, the making of apple syrup is profitable. The acids are removed by boiling the cider with precipitated chalk (calcium carbonate, or whiting). This neutralizes the acids of the cider, converting them into insoluble calcium salts, which settle to the bottom and are removed by decanation.

Add three-fifths of an ounce of precipitated chalk (obtainable at any drug store) for each gallon of cider used, bring to a boil, and boil vigorously for five minutes, removing the foam and scum as fast as formed. Pour into containers as tall as are available. Two-quart Mason jars will do, or even big preserving kettles. Let stand quietly for four or five hours. Then carefully pour off the clear liquid, throwing away all the sediment at the bottom. Boil the clear liquid rapidly down to a syrup, removing all scum. The syrup should boil at 220 degrees Fahrenheit.

The syrup is placed in bottles or Mason jars and sterilized by placing the containers in boiling water for 15 minutes. If the whole outfit is then allowed to cool slowly, the little sediment in the syrup will settle to the bottom and leave a clear, bright, very pleasing mild syrup, with a delightful apple flavor.

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